



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

July 12, 2017

Mr. Thomas D. Ray  
Site Vice President  
Oconee Nuclear Station  
Duke Energy Carolinas, LLC  
7800 Rochester Highway  
Seneca, SC 29672-0752

SUBJECT: OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3 – ISSUANCE OF  
AMENDMENTS REGARDING THE TECHNICAL SPECIFICATIONS FOR DRY  
SPENT FUEL STORAGE CASK LOADING AND UNLOADING  
(CAC NOS. MF8161, MF8162, AND MF8163)

Dear Mr. Ray:

The U.S. Nuclear Regulatory Commission (NRC, or the Commission) has issued the enclosed Amendment Nos. 404, 406, and 405 to Renewed Facility Operating Licenses DPR-38, DPR-47, and DPR-55, for the Oconee Nuclear Station, Units 1, 2, and 3, respectively. The amendments revise the Technical Specifications in response to the application from Duke Energy Carolinas, LLC dated July 20, 2016 (ONS-2016-052). The amendments revise Technical Specifications 3.7.12, "Spent Fuel Pool Boron Concentration," 3.7.18, "Dry Spent Fuel Storage Cask Loading and Unloading," and 4.4, "Design Features - Dry Spent Fuel Storage Cask Loading and Unloading," to remove requirements that no longer pertain to the independent spent fuel storage facility general license. The staff's safety evaluation of the amendments is enclosed. A Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

A handwritten signature in black ink that reads "James R. Hall for".

Audrey L. Klett, Project Manager  
Plant Licensing Branch II-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-269, 50-270, and 50-287

Enclosures:

1. Amendment No. 404 to DPR-38
2. Amendment No. 406 to DPR-47
3. Amendment No. 405 to DPR-55
4. Safety Evaluation

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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

DUKE ENERGY CAROLINAS, LLC

DOCKET NO. 50-269

OCONEE NUCLEAR STATION, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 404  
Renewed License No. DPR-38

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment to the Oconee Nuclear Station, Unit 1 (the facility), Renewed Facility Operating License No. DPR-38, filed by Duke Energy Carolinas, LLC (the licensee), dated July 20, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

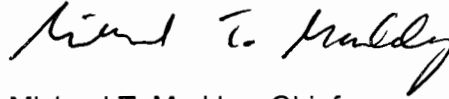
2. Accordingly, the license is hereby amended by changes to the Operating License and Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 3.B of Renewed Facility Operating License No. DPR-38 is hereby amended to read as follows:

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 404, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Michael T. Markley, Chief  
Plant Licensing Branch II-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Attachment:  
Changes to Renewed Facility  
Operating License No. DPR-38  
and the Technical Specifications

Date of Issuance: July 12, 2017



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

DUKE ENERGY CAROLINAS, LLC

DOCKET NO. 50-270

OCONEE NUCLEAR STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 406  
Renewed License No. DPR-47

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment to the Oconee Nuclear Station, Unit 2 (the facility), Renewed Facility Operating License No. DPR-47, filed by Duke Energy Carolinas, LLC (the licensee), dated July 20, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

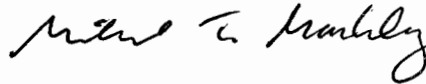
2. Accordingly, the license is hereby amended by changes to the Operating License and Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 3.B of Renewed Facility Operating License No. DPR-47 is hereby amended to read as follows:

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 406, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Michael T. Markley, Chief  
Plant Licensing Branch II-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Attachment:  
Changes to Renewed Facility  
Operating License No. DPR-47  
and the Technical Specifications

Date of Issuance: July 12, 2017



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

DUKE ENERGY CAROLINAS, LLC

DOCKET NO. 50-287

OCONEE NUCLEAR STATION, UNIT 3

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 405  
Renewed License No. DPR-55

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment to the Oconee Nuclear Station, Unit 3 (the facility), Renewed Facility Operating License No. DPR-55, filed by Duke Energy Carolinas, LLC (the licensee), dated July 20, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

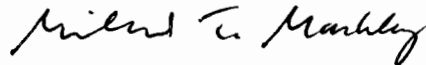
2. Accordingly, the license is hereby amended by changes to the Operating License and Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 3.B of Renewed Facility Operating License No. DPR-55 is hereby amended to read as follows:

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 405, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Michael T. Markley, Chief  
Plant Licensing Branch II-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Attachment:  
Changes to Renewed Facility  
Operating License No. DPR-55  
and the Technical Specifications

Date of Issuance: July 12, 2017

ATTACHMENT TO

AMENDMENT NO. 404 RENEWED FACILITY OPERATING LICENSE NO. DPR-38

AMENDMENT NO. 406 RENEWED FACILITY OPERATING LICENSE NO. DPR-47

AMENDMENT NO. 405 RENEWED FACILITY OPERATING LICENSE NO. DPR-55

OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3

DOCKET NOS. 50-269, 50-270, AND 50-287

Replace the following pages of the Renewed Facility Operating Licenses and the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove Pages

Insert Pages

*Operating Licenses*

*Operating Licenses*

License No. DPR-38, page 3

License No. DPR-38, page 3

License No. DPR-47, page 3

License No. DPR-47, page 3

License No. DPR-55, page 3

License No. DPR-55, page 3

*Technical Specifications*

*Technical Specifications*

3.7.12-1

3.7.12-1

3.7.18-1

3.7.18-1

4.0-3

4.0-3



A. Maximum Power Level

The licensee is authorized to operate the facility at steady state reactor core power levels not in excess of 2568 megawatts thermal.

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 404 are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

C. This license is subject to the following antitrust conditions:

Applicant makes the commitments contained herein, recognizing that bulk power supply arrangements between neighboring entities normally tend to serve the public interest. In addition, where there are net benefits to all participants, such arrangements also serve the best interests of each of the participants. Among the benefits of such transactions are increased electric system reliability, a reduction in the cost of electric power, and minimization of the environmental effects of the production and sale of electricity.

Any particular bulk power supply transaction may afford greater benefits to one participant than to another. The benefits realized by a small system may be proportionately greater than those realized by a larger system. The relative benefits to be derived by the parties from a proposed transaction, however, should not be controlling upon a decision with respect to the desirability of participating in the transaction. Accordingly, applicant will enter into proposed bulk power transactions of the types hereinafter described which, on balance, provide net benefits to applicant. There are net benefits in a transaction if applicant recovers the cost of the transaction (as defined in ¶1 (d) hereof) and there is no demonstrable net detriment to applicant arising from that transaction.

1. As used herein:

- (a) "Bulk Power" means electric power and any attendant energy, supplied or made available at transmission or sub-transmission voltage by one electric system to another.
- (b) "Neighboring Entity" means a private or public corporation, a governmental agency or authority, a municipality, a cooperative, or a lawful association of any of the foregoing owning or operating, or proposing to own or operate, facilities for the generation and transmission of electricity which meets each of

A. Maximum Power Level

The licensee is authorized to operate the facility at steady state reactor core power levels not in excess of 2568 megawatts thermal.

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 406 are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

C. This license is subject to the following antitrust conditions:

Applicant makes the commitments contained herein, recognizing that bulk power supply arrangements between neighboring entities normally tend to serve the public interest. In addition, where there are net benefits to all participants, such arrangements also serve the best interests of each of the participants. Among the benefits of such transactions are increased electric system reliability, a reduction in the cost of electric power, and minimization of the environmental effects of the production and sale of electricity.

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A. Maximum Power Level

The licensee is authorized to operate the facility at steady state reactor core power levels not in excess of 2568 megawatts thermal.

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 405 are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

C. This license is subject to the following antitrust conditions:

Applicant makes the commitments contained herein, recognizing that bulk power supply arrangements between neighboring entities normally tend to serve the public interest. In addition, where there are net benefits to all participants, such arrangements also serve the best interests of each of the participants. Among the benefits of such transactions are increased electric system reliability, a reduction in the cost of electric power, and minimization of the environmental effects of the production and sale of electricity.

Any particular bulk power supply transaction may afford greater benefits to one participant than to another. The benefits realized by a small system may be proportionately greater than those realized by a larger system. The relative benefits to be derived by the parties from a proposed transaction, however, should not be controlling upon a decision with respect to the desirability of participating in the transaction. Accordingly, applicant will enter into proposed bulk power transactions of the types hereinafter described which, on balance, provide net benefits to applicant. There are net benefits in a transaction if applicant recovers the cost of the transaction (as defined in ¶1 (d) hereof) and there is no demonstrable net detriment to applicant arising from that transaction.

1. As used herein:

- (a) "Bulk Power" means electric power and any attendant energy, supplied or made available at transmission or sub-transmission voltage by one electric system to another.
- (b) "Neighboring Entity" means a private or public corporation, a governmental agency or authority, a municipality, a cooperative, or a lawful association of any of the foregoing owning or operating, or proposing to own or operate, facilities for the generation and transmission of electricity which meets each of

3.7 PLANT SYSTEMS

3.7.12 Spent Fuel Pool Boron Concentration

LCO 3.7.12 The spent fuel pool boron concentration limit shall be within limits.

APPLICABILITY: When fuel assemblies are stored in the spent fuel pool or when fuel assemblies are in a site-specific licensed dry spent fuel storage cask located in the spent fuel pool.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. Spent fuel pool boron concentration not within limit.</p>	<p>-----NOTE----- LCO 3.0.3 is not applicable. -----</p>	
	<p>A.1 Suspend movement of fuel assemblies in the spent fuel pool.</p> <p><u>AND</u></p> <p>A.2 Initiate action to restore spent fuel pool boron concentration to within limit.</p>	

3.7 PLANT SYSTEMS

3.7.18 Dry Spent Fuel Storage Cask Loading and Unloading

LCO 3.7.18            The combination of initial enrichment, burnup and post-irradiation cooling time of each fuel assembly in a dry spent fuel storage cask shall meet the criteria of Table 3.7.18-1.

APPLICABILITY:    Whenever any fuel assembly is in a site-specific licensed dry spent fuel storage cask located in the spent fuel pool.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Requirements of the LCO not met.	A.1        -----NOTE----- LCO 3.0.3 is not applicable. -----  Initiate action to move the noncomplying fuel assembly to an acceptable storage location.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.18.1        Verify by administrative means the initial enrichment, burnup, and post-irradiation cooling time of the fuel assembly is in accordance with Table 3.7.18-1.	Prior to placing the fuel assembly into a dry spent fuel storage cask for loading  <u>AND</u>  Prior to placing a dry spent fuel storage cask into the spent fuel pool for unloading.

## 4.0 DESIGN FEATURES

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4.4 Dry Spent Fuel Storage Cask Loading and Unloading for ISFSI site-specific licensed storage casks (site-specific licensed storage casks are contained in horizontal storage modules 1 through 40).

### 4.4.1 Criticality

Dry spent fuel storage cask loading or unloading in the spent fuel pool shall be maintained with:

- a. Fuel assemblies having a maximum nominal U-235 enrichment of 5.0 weight percent;
  - b.  $k_{\text{eff}} < 1.0$  if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR;
  - c.  $k_{\text{eff}} \leq 0.95$  if fully flooded with water borated to 430 ppm, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR. Maintaining the normal spent fuel pool boron concentration within the TS limits assures  $k_{\text{eff}} \leq 0.95$  for any accident condition.
  - d. Dry spent fuel storage cask designs limited to NUHOMS<sup>®</sup>-24P or NUHOMS<sup>®</sup>-24PHB.
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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION FOR  
AMENDMENT NO. 404 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-38  
AMENDMENT NO. 406 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-47  
AMENDMENT NO. 405 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-55

DUKE ENERGY CAROLINAS, LLC

OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3

DOCKET NOS. 50-269, 50-270, AND 50-287

1.0 INTRODUCTION

By letter ONS-2016-053 dated July 20, 2016,<sup>1</sup> Duke Energy Carolinas, LLC (the licensee), applied for license amendments to change the Technical Specifications (TSs) for the Oconee Nuclear Station, Units 1, 2, and 3 (Oconee), which are contained in Appendix A of Renewed Facility Operating Licenses DPR-38, DPR-47, and DPR-55. The licensee proposed to revise TS 3.7.12, "Spent Fuel Pool Boron Concentration," TS 3.7.18, "Dry Spent Fuel Storage Cask Loading and Unloading," and TS 4.4, "Design Features - Dry Spent Fuel Storage Cask Loading and Unloading," to limit the applicability of those TSs to the site-specific independent spent fuel storage installation (ISFSI) license rather than to both the site-specific and general licenses. The U.S. Nuclear Regulatory Commission (NRC or the Commission) published a proposed no significant hazards consideration determination in the *Federal Register* (FR) on February 14, 2017 (82 FR 10593).

2.0 REGULATORY EVALUATION

2.1 Description of the Dry Spent Fuel Storage Casks and Requirements

Dry cask storage allows spent fuel that has already been cooled in the spent fuel pool for several years to be surrounded by inert gas inside a container called a cask, which is typically a steel cylinder that is either welded or bolted closed. The steel cylinder provides containment of the spent fuel and stores multiple fuel assemblies. Each cylinder is surrounded by additional steel, concrete, or other material to provide radiation shielding. Dry storage canisters are transferred from spent fuel pools via transfer casks to horizontal storage modules stored in ISFSIs. An ISFSI is a facility that is designed and constructed for the interim storage of spent nuclear fuel. These facilities are licensed separately from a nuclear power plant. The NRC authorizes storage of spent nuclear fuel at an ISFSI in either a general or a site-specific license. The NRC issues ISFSI general licenses pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 72, "Licensing requirements for the Independent Storage of Spent

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<sup>1</sup> Batson, Scott L., Duke Energy Carolinas, LLC, letter to U.S. Nuclear Regulatory Commission, July 20, 2016, Agencywide Documents Access and Management System (ADAMS) Accession No. ML16209A222.

Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste,” Section 72.210, “General license issued,” which states, in part, that a general license is hereby issued for the storage of spent fuel in an ISFSI at power reactor sites to persons authorized to possess or operate nuclear power reactor under 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities.” An ISFSI general license authorizes storage of spent fuel in casks approved by the NRC at a site that is already licensed to possess fuel to operate a nuclear power plant. The conditions of the general license are contained in 10 CFR 72.212, which includes the condition that the general license for the storage of spent fuel in each cask fabricated under a Certificate of Compliance (CoC) shall commence upon the date that the particular cask is first used by the general licensee to store spent fuel, shall continue through any renewals of the CoC, unless otherwise specified in the CoC, and shall terminate when the cask’s CoC expires. A CoC is the certificate issued by the Commission that approves the design of a spent fuel storage cask in accordance with the provisions of 10 CFR Part 72, Subpart L. The CoC contains its own set of TSs in an appendix.

The NRC issues ISFSI site-specific licenses pursuant to 10 CFR 72.40. Prior to the 10 CFR 72.210 rulemaking for ISFSI general licenses, the NRC only issued site-specific licenses per an applicant’s request (for example, if an applicant requested to use a cask other than those approved in 10 CFR 72.214). ISFSI site-specific licenses contain requirements on topics such as leak testing and monitoring and specify the quantity and type of material the licensee is authorized to store at the site.

Oconee has an ISFSI general license and an ISFSI site-specific license. The site-specific license uses a site-specific version of the NUHOMS®-24P dry spent fuel storage system. The ISFSI was originally constructed with sufficient size to accommodate a maximum of 88 horizontal storage modules. However, only the first 40 modules were constructed and loaded with dry storage canisters under the ISFSI site-specific license. In 2009, the 20-year site-specific license No. SNM-2503 was renewed for an additional 40-year period.<sup>2</sup>

In the mid-1990s, the licensee elected to suspend further construction of the site-specific horizontal storage modules in favor of the Standardized NUHOMS®-24P system under the general license because of its modular design and improved thermal capacity. The NRC approved the use of the standardized dry storage canister design on January 23, 1995 (NRC Docket No. 72-1004<sup>3</sup>), as described in 10 CFR 72.214, “List of approved spent fuel storage casks.” The new system used the same dry storage canisters, transfer equipment, and ancillary equipment as the site-specific version. The modular general license horizontal storage modules are fabricated offsite and installed on new concrete storage pads constructed within the confines of the existing ISFSI. In 1997, Oconee installed a new and separate generally licensed ISFSI in addition to maintaining the existing site-specific licensed ISFSI.

Section 50.68, “Criticality accident requirements,” of 10 CFR contains criticality requirements for spent fuel pools. Part 72 of 10 CFR contains criticality requirements for ISFSI licenses and dry storage casks. On March 23, 2005, the NRC issued regulatory issue summary (RIS) 2005-05, “Regulatory Issues Regarding Criticality Analyses for Spent Fuel Pools and Independent Spent

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<sup>2</sup> Goshen, John, U.S. Nuclear Regulatory Commission, letter to David Baxter, June 25, 2009, ADAMS Package Accession No. ML091770024.

<sup>3</sup> McKirgan, John, U.S. Nuclear Regular Commission, letter to Jayant Bondre, TN Americas, LLC, March 31, 2017, ADAMS Package Accession No. ML17067A412).



Fuel Storage Installations,”<sup>4</sup> to advise addressees regarding potential inconsistencies among the regulatory bases of spent fuel pools and ISFSIs. The RIS also notified licensees of NRC’s determination that 10 CFR 50.68(b)(1) applies to the loading of dry spent fuel storage casks in the spent fuel pool. Paragraph 50.68(b)(1) of 10 CFR states that plant procedures shall prohibit the handling and storage at any one time of more assemblies than have been determined to be safely subcritical under the most adverse moderation conditions feasible by *unborated water*.

The dry spent fuel storage casks used at Oconee require soluble boron during loading in the spent fuel pool. Thus, the casks cannot meet the 10 CFR 50.68 requirements for maintaining subcritical conditions in unborated water. RIS 2005-05 described a resolution strategy that involved performing a criticality analysis for the spent fuel assemblies in the dry storage cask, assuming unborated water and taking credit for burnup (reactivity reduction during depletion) of the spent fuel assemblies, and then submitting the analysis to the NRC as part of a license amendment request to add a TS restricting the minimum burnup of fuel assemblies loaded in a particular cask design.

In response to the RIS, the licensee submitted License Amendment Request No. 2005-009, dated March 1, 2006, and supplemented by letter dated April 26, 2006.<sup>5</sup> By letter dated June 15, 2006,<sup>6</sup> the NRC approved the request and issued Amendment Nos. 351, 353, and 352 for Oconee, which added TS 3.7.18 and TS 4.4 and revised TS 3.7.12. TS Limiting Condition for Operation (LCO) 3.7.12 and its applicability state that the spent fuel pool boron concentration shall be within limits when fuel assemblies are stored in the spent fuel pool and when fuel assemblies are in a dry spent fuel storage cask located in the spent fuel pool. TS LCO 3.7.18 and its applicability state that the combination of initial enrichment, burnup, and post-irradiation cooling time of each fuel assembly in a dry spent fuel storage cask must meet the criteria of TS Table 3.7.18-1 whenever any fuel assembly is in a dry spent fuel storage cask located in the spent fuel pool. TS 4.4 provides required design features for dry spent fuel storage cask loading or unloading in the spent fuel pool.

The NRC recognized that the need to meet both of the 10 CFR 50.68 and Part 72 regulations and the differences in those regulations’ assumptions for maintaining subcritical conditions created an additional burden on licensees to show that credit for soluble boron is not required to preclude an accidental criticality in a water-filled, high-density dry storage cask used for storing fuel. Therefore, the NRC revised 10 CFR 50.68 by rulemaking, as documented in the FR notice dated November 16, 2006 (71 FR 66652), that became effective on January 30, 2007, per FR notice dated January 26, 2007 (72 FR 3705). The rulemaking added 10 CFR 50.68(c), which states, in part, that while a spent fuel storage cask approved under 10 CFR Part 72 is in the spent fuel pool, the requirements in §50.68(b) do not apply to the fuel located with that cask, and the requirements in 10 CFR Part 72, as applicable, and the requirements of the CoC for that cask apply to the fuel within that cask. Based on 10 CFR 50.68(c), the requirements of 10 CFR 50.68(b) no longer apply to general license dry shielded canisters when the cask is in the spent fuel pool.

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<sup>4</sup> “U.S. Nuclear Regulatory Commission, “NRC Regulatory Issue Summary 2005-005 Regulatory Issues Regarding Criticality Analyses for Spent Fuel Pools and Independent Spent Fuel Storage Installations,” March 23, 2005, ADAMS Accession No. ML043500532.

<sup>5</sup> Hamilton, Bruce, Duke Power, Oconee Nuclear Site, Units 1, 2 & 3, letter to U.S. Nuclear Regulatory Commission, March 1, 2006 and April 26, 2006, ADAMS Accession Nos. ML060720030, ML061240463, and ML061240464 (this document contains proprietary information and is not publicly available).

<sup>6</sup> Olshan, Leonard N., U.S. Nuclear Regulatory Commission, letter to Bruce H. Hamilton, Duke Power Company, LLC., June 15, 2006, ADAMS Package Accession No. ML061500172.

The FR notice (71 FR 66652) for the 10 CFR 50.68(c) rulemaking states that during the 535<sup>th</sup> meeting of the Advisory Committee for Reactor Safeguards on September 7, 2006, a concern was raised regarding any actions that would be required for licensees who have previously requested and been granted a license amendment to modify the plant TSs to comply with the criticality accident requirements of 10 CFR 50.68 for fuel in a 10 CFR Part 72 licensed cask in their spent fuel pool. The FR notice further stated that those licensees who have amended their 10 CFR Part 50 license to comply with 10 CFR 50.68 by including minimum fuel burnup limits, and who choose to take advantage of the 10 CFR 50.68(c) rulemaking must request removal of the previously amended portions of the 10 CFR Part 50 TSs as a conforming change consistent with the amended rule.

## 2.2 Licensee's Proposed Changes

The licensee proposed to revise TS requirements associated with dry spent fuel storage cask loading and unloading because those requirements no longer pertain to the ISFSI general license since the creation of 10 CFR 50.68(c) via rulemaking. The requirements of 10 CFR Part 72 and the CoC for the dry storage canisters pertain to the ISFSI general license. In its application dated July 20, 2016, the licensee stated that because 10 CFR 50.68(c) did not apply to ISFSI site-specific licenses, it proposed TS changes to reflect that the subject TSs remain in effect only for the site-specific licensed dry storage canisters.

In TS 3.7.12, "Spent Fuel Pool Boron Concentration," the licensee proposed to revise the APPLICABILITY statement of the limiting condition for operation to state (proposed additions are underlined and deletions are struck through), "When fuel assemblies are stored in the spent fuel pool ~~and~~ when fuel assemblies are in a site-specific licensed dry spent fuel storage cask located in the spent fuel pool." In its application, the licensee stated that the "and" was changed to an "or" to clarify that either of the conditions would need to be in effect rather than both.

In TS 3.7.18, "Dry Spent Fuel Storage Cask Loading and Unloading," the licensee proposed to revise the APPLICABILITY statement of the limiting condition for operation to state (proposed addition is underlined), "Whenever any fuel assembly is in a site-specific licensed dry spent fuel storage cask located in the spent fuel pool." The licensee also proposed to correct a typographical error in Surveillance Requirement 3.7.18.1 by changing the word "Figure" to "Table."

In TS 4.4, "Dry Spent Fuel Pool Boron Concentration," the licensee proposed to change the title of TS 4.4 to state (proposed addition is underlined), "Dry Spent Fuel Storage Cask Loading and Unloading for ISFSI site-specific licensed storage casks (site-specific licensed storage casks are contained in horizontal storage modules 1 through 40)."

The licensee also provided TS Bases changes corresponding to the proposed TS changes. In its application, the licensee stated that because 10 CFR 50.68(c) does not similarly apply to dry shielded canisters loaded under a site-specific license, the Oconee TS requirements approved in Amendment Nos. 351, 353, and 352<sup>7</sup> will continue to apply to those dry shielded canisters.

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<sup>7</sup> Olshan, Leonard N., U.S. Nuclear Regulatory Commission, letter to Bruce H. Hamilton, Duke Power Company, LLC., June 15, 2006, ADAMS Package Accession No. ML061500172.

## 2.3 Regulatory Review

The staff considered the following regulatory requirements, licensing and design basis information, and guidance during its review of the proposed changes.

### *Regulatory Requirements*

Paragraph 50.36(c) of 10 CFR requires that the TSs include items in the following categories: (1) safety limits, limiting safety system settings, and limiting control settings; (2) limiting conditions for operation; (3) surveillance requirements; (4) design features; and (5) administrative controls. Paragraph 50.36(c)(2) states that when an LCO is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the TSs until the condition can be met. Paragraph 50.36(c)(4) states that design features are those features of the facility such as materials of construction and geometric arrangements, which, if altered or modified, would have a significant effect on safety and are not covered in categories described in paragraphs (c)(1), (2), and (3).

Paragraph 50.68(b) of 10 CFR contains criticality requirements for the spent fuel pool, including requirements to adhere to specified maximum multiplication factor (i.e.,  $K_{\text{effective}}$ , or  $K_{\text{eff}}$ ) values when handling and storing fuel. Paragraph 50.68(c) states that while a spent fuel storage cask approved under 10 CFR Part 72 is in the spent fuel pool, the requirements in 10 CFR 50.68(b) do not apply to the cask, and the requirements of Part 72, as applicable, and the requirements of the CoC for that cask apply to the fuel within that cask.

Section 72.1 of 10 CFR states that the regulations in Part 72 establish requirements, procedures, and criteria for the issuance of licenses to receive, transfer, and possess power reactor spent fuel and other radioactive materials associated with spent fuel storage in an ISFSI and the terms and conditions under which the Commission will issue these licenses. Part 72 also establishes requirements, procedures, and criteria for the issuance of CoCs approving spent fuel storage cask designs.

Section 72.210 of 10 CFR states that a general license is hereby issued for the storage of spent fuel in an independent spent fuel storage installation at power reactor sites to persons authorized to possess or operate nuclear power reactors under 10 CFR Part 50 or 10 CFR Part 52.

The conditions of the ISFSI general license are contained in 10 CFR 72.212, "Conditions of general license issued under § 72.210," which includes the condition that the general license for the storage of spent fuel in each cask fabricated under a CoC shall commence upon the date that the particular cask is first used by the general licensee to store spent fuel, shall continue through any renewals of the CoC, unless otherwise specified in the CoC, and shall terminate when the cask's CoC expires.

Paragraph 72.236(c) of 10 CFR requires that spent fuel storage casks be designed and fabricated so that the spent fuel is maintained in a subcritical condition under credible conditions.

### *Licensing and Design Basis Information*

The updated final safety analysis report (UFSAR) includes information that describes the facility, presents the design bases and the limits on its operation, and presents a safety analysis of the

structures, systems, and components and of the facility as a whole. Section 9.1 of the UFSAR, Revision 22 describes fuel storage and handling. Section 9.1.2.3.2.3, "Criticality Analysis Methodology," states that the two principal methods of preventing criticality are limiting the fuel assembly array size and limiting assembly interaction by fixing the minimum separation between assemblies or inserting neutron poisons between assemblies. In order to justify storage of fuel up to 5.0 weight percent Uranium-235, the burnup credit approach was used in the spent fuel pools. The burnup credit approach to fuel rack criticality analysis requires calculation and comparison of reactivity values over a range of burnup and initial enrichment conditions. In order to accurately model characteristics of irradiated fuel which impact reactivity, a criticality analysis method capable of evaluating arrays of these irradiated assemblies is needed. The licensee used advanced nodal methodology combining CASMO-3/TABLES-3/SIMULATE-3 for this purpose. CASMO-3 is an integral transport theory code, SIMULATE-3 is a nodal diffusion theory code, and TABLES-3 is a linking code which reformats CASMO-3 data for use in SIMULATE-3. The results for the criticality methodology are validated by comparison to measured results of fuel storage critical experiments. Section 9.1.2.3.2.4 of the UFSAR states that as part of the criticality analysis for the spent fuel pools, abnormal and accident conditions are considered to verify that acceptable criticality margin is maintained for all conditions.

Section 9.1.2.4, "Safety Evaluation," of the UFSAR states that the storage rack design assures a  $k_{\text{eff}}$  of less than 1.0 even when the entire array of fuel assemblies, which are assumed to be in their most reactive condition and within the limits specified in the TSs, are immersed in unborated water at room temperature.

Section 3 of the UFSAR, Revision 22 describes the design of structures, components, equipment, and systems. Section 3.8.4.4, "Design and Analysis Procedures," states that the spent fuel pool slab was designed for the postulated cask drop accident. Section 15 of the UFSAR, Revision 22 describes accident analyses. Section 15.11.2.5.1, "Criticality Analyses for Dry Storage Transfer Cask Drop Scenarios," states that the potential for criticality in the spent fuel pools was analyzed using the methodology identified in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants: Resolution of Generic Technical Activity A-36," dated July 1980.<sup>8</sup>

At Oconee, the licensee uses AREVA Transnuclear, Inc. NUHOMS®-24P and NUHOMS®-PHB dry storage canisters. The Oconee ISFSI UFSAR, which was submitted to the NRC on June 30, 2016,<sup>9</sup> describes the fuel storage system pertaining to the site-specific ISFSI license. AREVA Transnuclear, Inc. submits biennial updates of its safety analysis report for its cask designs approved under 10 CFR 72.214. In its application dated July 20, 2016, the licensee stated that fuel loading and unloading operations for dry storage canisters take place in the cask pit area of the spent fuel pool. The cask pit is adjacent to the spent fuel storage racks in each of the spent fuel pools and is open to the rest of the spent fuel pool at all times. The dry storage canisters contain storage cells for 24 fuel assemblies. Eligible Babcock & Wilcox 15x15 fuel assemblies with initial enrichments less than or equal to 5.0 weight percent Uranium-235 may be stored in either the NUHOMS®-24P and NUHOMS®-PHB dry storage canisters as long as the fuel assemblies meet the minimum burnup and cooling time requirements specified in the CoC for the Standardized NUHOMS dry storage canister design.

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<sup>8</sup> U.S. Nuclear Regulatory Commission, NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants, July 31, 1980, ADAMS Accession No. ML070250180.

<sup>9</sup> Batson, Scott L. Duke Energy Carolinas, LLC, letter to U.S. Nuclear Regulatory Commission, June 30, 2016, ADAMS Package Accession No. ML16195A389.

## *Guidance*

NUREG-1536, "Standard Review Plan for Dry Cask Storage Systems," Revision 1, dated July 2010,<sup>10</sup> provides guidance to the staff for reviewing applications for a CoC of a dry storage system for use at a general license facility. Its objectives include providing a basis that promotes a consistent regulatory review of an application for a dry storage system; presenting a basis for the review scope; and identifying acceptable approaches to meeting regulatory requirements.

### 3.0 TECHNICAL EVALUATION

The NRC staff evaluated the licensee's application to determine if the proposed changes are consistent with the guidance, regulations, and licensing information discussed in Section 2 of this safety evaluation. In determining whether an amendment to a license will be issued, the Commission is guided by the considerations that govern the issuance of initial licenses to the extent applicable and appropriate. The staff reviewed the proposed changes for conformance to the design bases described in the UFSAR, for any impacts to the licensee's ability to meet criticality requirements and cask loading and unloading requirements, and compliance with 10 CFR 50.36. Where the regulations condition the ISFSI general license, there is no need for duplicative requirements in the operating license TSs; the regulations provide the necessary reasonable assurance of the health and safety of the public.

#### 3.1 Conformance with 10 CFR 50.68(c) Rulemaking

The FR notice (71 FR 66648) for the 10 CFR 50.68(c) rulemaking states that the NRC amended its regulations so that the requirements governing criticality control for spent fuel pool storage racks do not apply to the fuel within a spent fuel storage cask when a cask is in a spent fuel pool. These casks are subject to separate criticality control requirements. The rulemaking was necessary to avoid applying two different sets of criticality control requirements to fuel within a package or cask in a spent fuel pool. The FR notice further stated that those licensees who have amended their 10 CFR Part 50 license to comply with 10 CFR 50.68 by including minimum fuel burnup limits and who choose to take advantage of the rulemaking must request removal of the previously amended portions of the 10 CFR Part 50 TSs as a conforming change consistent with the amended rule.

Paragraph 50.68(c) of 10 CFR states that while a spent fuel storage cask approved under 10 CFR Part 72 is in the spent fuel pool, the requirements in 10 CFR 50.68(b) do not apply to the fuel located within that cask, and the requirements of Part 72, as applicable, and the requirements of the CoC for that cask do apply to the fuel within that cask. The licensee requested to modify its TSs so that the spent fuel pool boron concentration, dry spent fuel storage cask loading and unloading, and design feature requirements are applicable only to the spent fuel and casks loaded under its ISFSI site-specific license and do not apply to the spent fuel and casks loaded under its ISFSI general license and CoC. The ISFSI general license and CoC for the casks are issued in accordance with 10 CFR 72.210, 10 CFR 72.212, and 10 CFR 72.238. Therefore, the staff finds that the licensee's proposed TS changes meet the provisions of the 10 CFR 50.68(c) rulemaking for modifying its 10 CFR Part 50 operating licenses as a conforming change to comply with the amended rule.

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<sup>10</sup> U.S. Nuclear Regulatory Commission, NUREG-1536, Rev. 1, "Standard Review Plan for Spent Fuel Dry Storage Systems at a General License Facility," ADAMS Accession No. ML101040620.

### 3.2 Criticality Requirements during Normal and Accident Conditions

The NRC staff considered whether removing the ISFSI general license related activities from the operating license TSs would impact the licensee's ability to maintain fuel storage criticality requirements. The staff determined that the NRC's issuance of the Part 72 ISFSI general license and the CoC, which has its own TSs, provides reasonable assurance that the ISFSI general license requirements are adequate for maintaining fuel storage criticality requirements pertaining to the general license casks. In order to use its ISFSI general license, the licensee must meet 10 CFR Part 72 requirements and maintain the spent fuel pool criticality requirements during normal and accident conditions (i.e., keep the spent fuel pool subcritical). Paragraph 72.236(c) has regulatory requirements pertaining to criticality and requires that the cask system be designed to be subcritical under credible conditions. In issuing the general license and CoC, the staff uses the guidance in NUREG-1536, which provides the basic acceptance criteria that  $k_{\text{eff}}$ , which is a measure of the reactivity of a system, including all biases and uncertainties at a 95 percent confidence level, cannot exceed 0.95 under all credible normal, off-normal, and accident conditions. Therefore, the staff concludes that the regulations that condition the ISFSI general license provide the necessary reasonable assurance of the health and safety of the public and that there is no need for duplicative requirements in the operating license TSs.

The NRC staff also reviewed the design basis information in Sections 9.1.2.3.2.3 and 9.1.2.4 of the UFSAR, Revision 22. The UFSAR states that the station complies with the criticality accident requirements of 10 CFR 50.68(b). The UFSAR also states that the two principal methods of preventing criticality are limiting the fuel assembly array size and limiting assembly interaction by fixing the minimum separation between assemblies and/or inserting neutron poisons between assemblies. The UFSAR also states that the rack design assures a  $k_{\text{eff}}$  of less than 1.0 even when the entire array of fuel assemblies, assumed to be in their most reactive condition and within the limits specified in the TSs, are immersed in unborated water at room temperature. The proposed TS changes do not affect fuel assembly array size or fuel assembly interaction. The proposed TS changes do not affect the immersion of the fuel assembly arrays in unborated water. The staff reviewed the UFSAR's description of the criticality analysis and determined that the proposed TS changes do not affect the criticality analysis for the spent fuel pool and the rack design, which assures acceptable criticality margin is maintained for all conditions. The staff also determined that the proposed changes do not change the methodology described in Section 2.3 of this safety evaluation for performing spent fuel pool criticality analyses. Therefore, the staff concludes that the spent fuel will continue to meet criticality requirements under all dry storage loading and unloading conditions, consistent with 10 CFR Part 72 and 10 CFR 50.68(b) requirements.

The NRC staff evaluated whether removing the ISFSI general license related activities from the operating license TSs would impact the licensee's ability to maintain subcritical conditions during a loading operation cask drop accident. The staff reviewed the proposed changes against the information in Section 15.11.2.5.1 of the UFSAR. The cask drop accident is concerned with criticality potential, radiological dose, and physical damage to both the pool and the fuel residing in the spent fuel racks resulting from the failure of the overhead crane or handling equipment. The licensee's analyses assumed the racks and the fuel were deformed such that the  $k_{\text{eff}}$  was maximized. The analyses had verified that subcritical conditions in spent fuel pool will be maintained after a dry storage cask drop accident. The staff determined that the proposed TS changes do not affect the crane or handling equipment nor the cask design and do not affect the assumptions listed in the

UFSAR for the accident analysis. The proposed TS changes do not create new credible failure modes or accidents. Therefore, the staff concludes that the proposed TS changes will not impact the licensee's continuing conformance with the UFSAR.

### 3.3 Compliance with 10 CFR 50.36

Paragraph 50.36(c) of 10 CFR requires that the TSs include LCOs and design features. The licensee proposed to modify LCO 3.7.12 and LCO 3.7.18 by removing the applicability of those LCOs to the spent fuel and casks loaded under the ISFSI general license and limiting the applicability of those LCOs to the spent fuel and casks loaded under the ISFSI site-specific license. The licensee also proposed to modify TS 4.4 to limit the design features requirements of that section to the ISFSI site-specific license storage casks and remove the applicability of that TS to the spent fuel and casks loaded under the ISFSI general license. Based on the staff's conclusions in Sections 3.1 and 3.2 of this safety evaluation, the requirements of 10 CFR 50.68(c), and the requirements contained in the CoC for the NUHOMS® dry cask storage system authorized for use in accordance with 10 CFR Part 72, the staff finds the change in applicability of the subject TSs acceptable. The staff finds that the proposed changes to limit applicability of the subject TSs to the spent fuel and casks loaded under the ISFSI site-specific license result in the TSs continuing to meet 10 CFR 50.36(c)(2) and 10 CFR 50.36(c)(4) and, therefore, are acceptable.

The licensee also proposed to correct a typographical error in Surveillance Requirement 3.7.18.1 by changing the word "Figure" to "Table." TS page 3.7.18-1 currently states "Table" in Surveillance Requirement 3.7.18.1, as approved and issued in Amendment Nos. 351, 353, and 352, which were the last amendments to that TS page. Therefore, the staff finds that the proposed change is unnecessary because it was previously found acceptable and issued. TS page 3.7.18-1 issued as part of these amendments states "Table" in the subject surveillance requirement.

### 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the staff notified the State of South Carolina officials (i.e., Ms. Susan Jenkins, Manager, Infectious and Radioactive Waste Management; and Mr. Mark Yeager, Manager, Environmental Health, of the South Carolina Department of Health and Environmental Control) by telephone and electronic mail (e-mail) on June 16, 2017,<sup>11</sup> of the proposed issuance of the amendments. The State officials had no comments.

### 5.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20 and change inspections or SRs. The NRC staff has determined that the amendments involve no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding, which was published in the FR on February 14, 2017 (82 FR 10593), that the amendments involve no significant hazards consideration, and there has been no public comment on such finding. Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in

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<sup>11</sup> Klett, Audrey, U.S. Nuclear Regulatory Commission, e-mail to Susan E. Jenkins and Mark A. Yeager, Bureau of Land & Waste Management, June 16, 2017, ADAMS Accession No. ML17170A176.

10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

## 6.0 CONCLUSION

Based on the aforementioned considerations, the NRC staff concluded that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: Fred M. Forsaty, NRR/DSS  
Audrey L. Klett, NRR/DORL

Date: July 12, 2017



SUBJECT: OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3 – ISSUANCE OF AMENDMENTS REGARDING THE TECHNICAL SPECIFICATIONS FOR DRY SPENT FUEL STORAGE CASK LOADING AND UNLOADING (CAC NOS. MF8161, MF8162, AND MF8163) DATED JULY 12, 2017

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- M. Hamm, NRR/DSS
- S. Krepel, NRR/DSS

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